

MACROINVERTEBRATE AND FISH COMMUNITY ASSESSMENT  
ON TWO UNNAMED TRIBUTARIES OF HAWK CREEK NEAR  
THE NEVADA GOLDFIELD, INC. BARITE HILL PROJECT,  
McCORMICK COUNTY, SOUTH CAROLINA

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Submitted To:

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McCormick, South Carolina

Submitted By:

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## I. SUMMARY

An assessment of the fish and macroinvertebrate communities of the two unnamed tributaries of Hawe Creek, McCormick County, South Carolina, which receive drainage from the Barite Hill Project operated by NEVADA GOLDFIELDS, INC. was conducted by SHEALY ENVIRONMENTAL SERVICES, INC. on February 25 and 28, 1992. The results of this assessment indicated the two streams support relatively diverse fish and macroinvertebrate communities and that little, if any, impact has occurred as a result of the operation of the mine.

The water chemistry parameters (temperature, dissolved oxygen, pH and conductivity) measured in conjunction with this assessment indicated that no impact has occurred due to the operation on the mine and that all parameters measured were within the standards for class B waters established by the state of South Carolina.

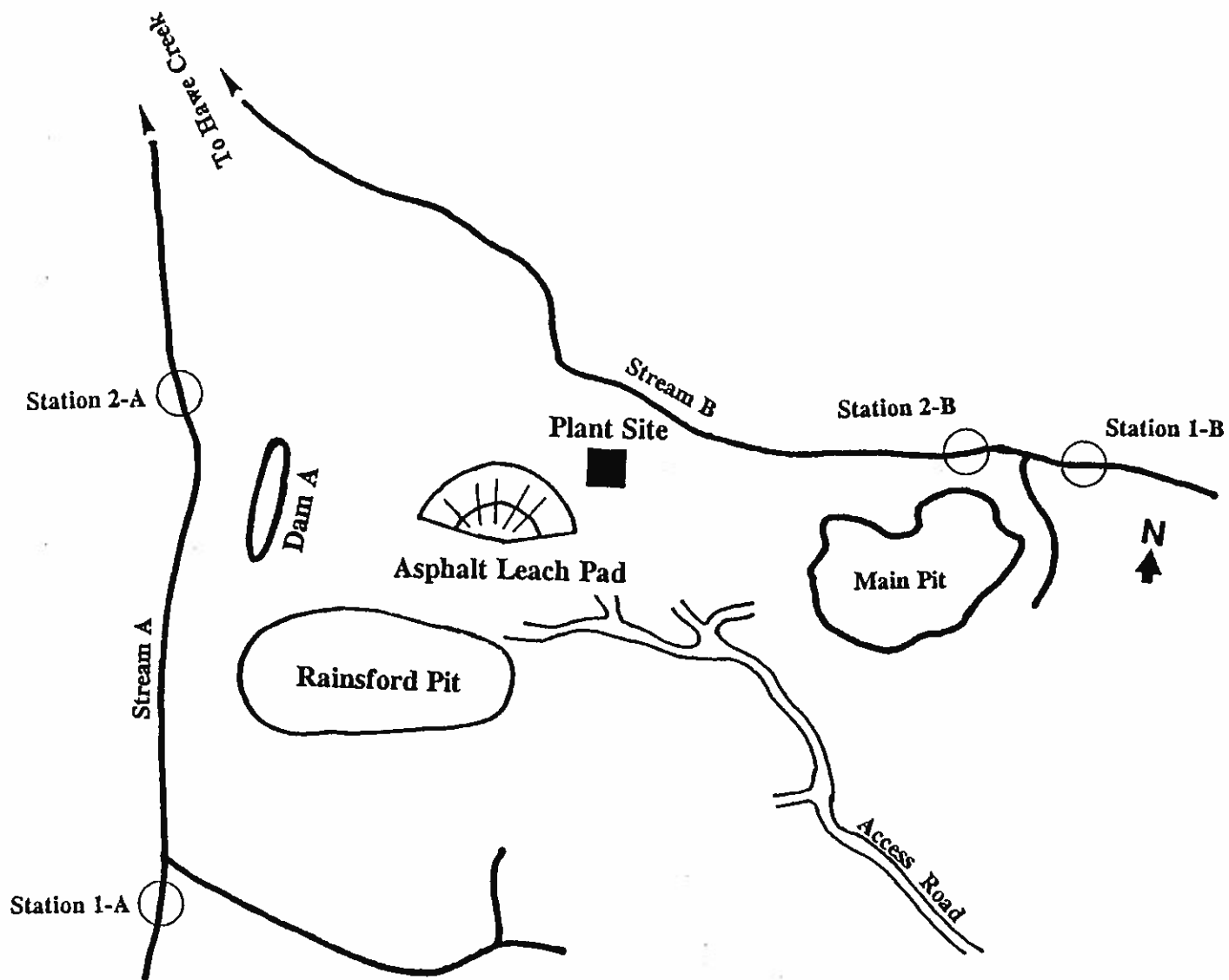
## II. INTRODUCTION

On February 25 and 28, 1992, SHEALY ENVIRONMENTAL SERVICES, INC. (SCDHEC Laboratory Certification No. 26103) conducted a fish and macroinvertebrate community assessment on two unnamed tributaries of Hawe Creek, which are potentially impacted by the Barite Hill Project operated by NEVADA GOLDFIELDS, INC. The objectives of this study was to determine the present condition of the stream communities and to establish a baseline for future assessments.

## III. DESCRIPTION OF STUDY AREA

Collections of fish and macroinvertebrates were made from an upstream and downstream site on each of the two streams (Figure 1). Station 1A served as the reference site for stream A. The stream at this location flows through a mixed hardwood forest and is approximately 1.5 to 2.5 meters wide with a depth 0.1 meters in the riffle areas and 0.75 meters in the pools.

Station 2A was located approximately one hundred meters downstream of the mine site. The stream at this location was similar to the reference site with alternating shallow riffle areas and 0.5 - 0.75 meter deep pools. The stream banks at this location were more open than at the reference site and the stream exhibited signs of a small amount of sediment loading from upstream sources.



**Figure 1.** Sampling station on the two unnamed tributaries of Hawe Creek receiving drainage from the Barite Hill Project operated by NEVADA GOLDFIELDS, INC., McCormick County, South Carolina.

Station 1B served as the reference site for stream B. The stream at this location flowed through an undisturbed mixed hardwood forest. This stream was similar to stream A in physical characteristics with a width of 1.0 to 2.5 meters. The depth ranged from 0.1 meters in the riffle areas to 0.75 meters in the pools. Station 2B was located approximately 20 meters downstream of the confluence with a small order first branch running parallel to the mine site. The characteristics were essentially the same as those of station 1B, with alternating shallow riffle areas and pools.

#### IV. METHODS AND MATERIALS

Qualitative collections of aquatic macroinvertebrates were made with a D-frame aquatic dip net, a U.S. Standard no 30 sieve, and by hand picking organisms from substrates with forceps. The multiple habitat approach, where specimens from all available habitats (stream margins, leaf packs, aquatic vegetation, water-soaked logs and sand deposits) are pooled to form one aggregate sample was utilized as the sampling procedure. Samples were preserved in the field with 70% Ethanol. Sampling procedures and habitat types were kept similar at each station to enable species and numerical population comparisons between stations.

Fish sampling was conducted by a two-person team using a Coffelt Model Mark 10 Backpack Electrofisher. Sampling was conducted along a 100 m length of stream. Shocking times were kept at 900 seconds at all sampling locations to enable species and numerical population comparisons between station.



Water chemistry parameters taken at each station in conjunction with the macroinvertebrate sampling were: pH (Orion Model SA2100), water temperature (stick thermometer), conductivity (Yellow Springs Instrument Model 33), and dissolved oxygen (Yellow Springs Instrument Model 57).

Upon return to the laboratory, macroinvertebrate collections were sorted from debris with the aid of a stereo microscope. The macroinvertebrates were identified to the lowest positive taxonomic level and counted with the aid of appropriate microscopic techniques and taxonomic keys (see Appendix A). All fish and macroinvertebrates collected will be maintained in SHEALY ENVIRONMENTAL SERVICES, INC.'s voucher collection for three years or placed into our permanent reference collection.

Comparison of the macroinvertebrate communities was based on changes in taxonomic composition between stations and on known tolerance levels and life history strategies of the organisms encountered. To facilitate data analysis, the USPEA's rapid bioassessment protocol III was utilized. This method uses a series of metrics calculated for the stations downstream from the discharge point and compared the results with an upstream control site (USEPA, 1989). These metrics are listed in Table 2 and include: 1) taxa richness or the number of different taxa found at a particular station, which is a measure of diversity; 2) EPT index, the number of taxa from the insect orders Ephemeroptera, Plecoptera, and Trichoptera found at a station. These three insect orders are considered to be generally intolerant of adverse water quality conditions, and therefore, a reduction in these taxa is indicative of reduced water quality; 3) ratio of EPT and Chironomidae abundance, uses relative abundance of these indicator groups as a measure of community balance, good biotic condition is reflected in communities having fairly even distribution among these four groups; 4) percent contribution

of dominant taxon, an indication of community balance, a community dominated by relatively few species is indicative of environmental stress; 5) community loss index, measures the loss of species between a reference station or control and a study site and is an index of dissimilarity, with values increasing as the degree of dissimilarity from the reference station increases; and 6) Jaccard Coefficient of Community Similarity, measures the degree of similarity in taxonomic composition between two stations in terms of taxon presence or absence. Values range from 0 to 1.0, increasing as the degree of similarity increases.

## V. RESULTS AND DISCUSSION

### A. Physicochemical Analysis

The water chemistry data taken in conjunction with the fish and macroinvertebrate collections are given in Table 1. None of the measured parameters (temperature, dissolved oxygen, pH and conductivity) appear to be affected by the operation of the mine and all were within the standards for Class B waters established by the state of South Carolina.

Table 1. Physicochemical data collected from two unnamed tributaries of Hawe Creek Near the NEVADA GOLDFIELDS, INC.'s. Barite Hill Project February 1992.				
	Stream A		Stream B	
Parameters	1	2	1	2
Water Temp. (°C)	12.0	10.0	9.5	10.0
pH (SU)	6.94	6.75	6.84	6.97
Conductivity (umhos/cm)	285	193	138	144
Dissolved Oxygen (mg/l)	11.5	11.5	11.0	11.5

## B. Fish Community Analysis

The result of the fish community analysis are presented in Table 2. A total of 314 specimens representing 9 taxa were recorded from the two streams. The data reflects the low species diversity and the relatively low numbers of specimens generally found in small first and second order coastal plains streams. A total of 6 species were recorded from stream A, with 103 specimens representing 3 taxa from station 1A, and 22 specimens representing 4 taxa from station 2A. A total of 189 specimens were collected from stream B, with 92 specimens representing 5 species and 97 specimens representing 6 species. The data reflects little or no impact on the species composition of the two streams. The lower numbers of individuals collected at station 2A, may be the result of variation in the distribution of the stream's fish populations or the result of sample variation, however continued monitoring is necessary in order to determine the actual reasons.

## C. Macroinvertebrate Community Analysis

The results of the macroinvertebrate community analysis are presented in Table 3. A total of 326 specimens representing 50 taxa were collected from Stream A and a total of 621 specimens representing 37 taxa were collected from stream B.

### Stream A

The reference site (Station 1A) yielded 139 specimens representing 33 taxa. An EPT index of 13 was calculated for this station. The Chironomidae were represented to 10 taxa. The EPT/Chironomidae abundance ration was 1.74. The dominant taxon was *Stenonema modestum* which represented 14% of the specimens collected.

Table 2. Fish species and number of specimens collected in conjunction with the instream community assessment of two unnamed tributaries of Howe Creek near the Barite Hill Project, NEVADA GOLDFIELDS, INC., McCormick County, South Carolina.

	Station			
	1-A	2-A	1-B	2-B
Catostomidae				
<i>Erimyzon oblongus</i> (Creek Chubsucker)		4	51	
Centrarchidae				
<i>Lepomis auritus</i> (Redbreast Sunfish)			4	
<i>Lepomis cyanellus</i> (Green Sunfish)	16		3	1
<i>Lepomis macrochirus</i> (Bluegill Sunfish)	2		14	11
<i>Lepomis marginatus</i> (Dollar Sunfish)				2
Cyprinidae				
<i>Clinostomus funduloides</i> (Roseyside Dace)		5	20	16
<i>Semotilus atromaculatus</i> (Creek Chub)	85	12		66
Ictaluridae				
<i>Ameiurus catus</i> (White Catfish)		1		
Poeciliidae				
<i>Gambusia holbrooki</i> (Eastern Mosquitofish)				2
TOTAL/STATION	103	22	92	97
TOTAL/STREAM	125		189	
TOTAL SPECIES/STATION	3	4	5	6
TOTAL SPECIES/STREAM	6		8	

The study site (station 2A) yielded 187 specimens representing 38 taxa. An EPT index of 13 was calculated for this station. The Chironomidae were represented by 8 taxa. The EPT/Chironomidae abundance ratio was 4.48. The dominant taxon was *Stenonema modestum* which contributed 28% of the specimens. The community loss index value of 0.32 and the similarity index value of 0.42 comparing station 2A with station 1A indicate that these two stations are similar.

#### Stream B

The reference site (station 1B) yielded 170 specimens representing 21 taxa. An EPT index of 7 was calculated for this station. The Chironomidae were represented by 6 taxa. The EPT/Chironomidae abundance ratio was 0.88. The dominant taxon was *Polypedilum aviceps* which contributed 34% of the specimens collected.

The study site (station 1B) yielded 451 specimens representing 29 taxa. An EPT index of 10 was calculated for this station. The Chironomidae were represented by 9 taxa. The EPT/Chironomidae abundance ratio was 0.42. The dominant taxon was *Polypedilum aviceps* which contributed 45% of the specimens collected. The community loss index value of 0.28 and the similarity index value of 0.35 indicate station 2B is relatively similar to station 1B.

#### IV: CONCLUSIONS

The results of the fish and macroinvertebrate community analyses indicate little or no impact has resulted from the operation of the Barite Hill Project on the two streams receiving drainage from the mine site. Both streams appear to support fish and macroinvertebrate populations which are typical for first and second order coastal plain streams.

Table 3. Fish assessment and macroinvertebrate for two unnamed tributaries of Hawe Creek near the Barite Hill Project, NEVADA GOLDFIELDS, INC., McCormick, South Carolina, February 25 and 28, 1992.

Taxon	Station			
	1-A	2-A	1-B	2-B
Porifera				
Demospongia				
Spongillidae				
<i>Spongilla lacustris</i>		1		
Nematoda				
Genus sp.			1	
Annelida				
Oligochaeta				
Genus sp.	2	3	4	3
Arthropoda				
Malacostraca				
Amphipoda				
Gammaridae				
<i>Crangonyx</i> sp.	2	7		
Isopoda				
Asellidae				
<i>Asellus</i> sp.	11	3	10	1
Decapoda				
Cambaridae				
<i>Cambarus</i> sp.	3	3		5
Hexapoda				
Ephemeroptera				
Baetidae				
<i>Baetis</i> sp.		2	10	
<i>Cloeon</i>		4		
Caenidae				
<i>Caenis</i> sp.		2	8	
Ephemerellidae				
<i>Ephemerella</i> sp.		1		
<i>Eurylophella</i> sp.	1	4		
Heptageniidae				
<i>Stenonema modestum</i>	19	52	44	74
Leptophlebiidae				
<i>Habrophlebiodes</i> sp.		1		
<i>Leptophlebia</i> sp.	3	2		
Odonata				
Aeshnidae				
<i>Boyeria vinosa</i>		1		1
Calopterygidae				
<i>Calopteryx</i> sp.	3	12		1

Table 3. Continued

Taxon	Station			
	1-A	2-A	1-B	2-B
Coenagrionidae				
<i>Argia sedula</i>	6	3		
<i>Enallagma</i> sp.	2	5		
Corduliidae				
<i>Somatochlora</i> sp.	1			
Macromiidae				
<i>Macromia</i> sp.	1			
Plecoptera				
Nemouridae				
<i>Amphinemura delosa</i>	1		2	
Heteroptera				
Nepidae				
<i>Ranatra buenoi</i>		1		
Veliidae				
<i>Microvelia</i> sp.	1			
Coleoptera				
Dryopidae				
<i>Helichus</i> sp.	2A		1A	
Megaloptera				
Corydalidae				
<i>Nigronia fasciatus</i>			1	
Sialidae				
<i>Sialis</i> sp.		1		
Trichoptera				
Hydropsychidae				
<i>Cheumatopsyche</i> spp.	8	3		4
<i>Hydropsyche</i> spp.	5	4	2	
<i>Potamyia</i> sp.	1	3		3
Leptoceridae				
<i>Triaenodes</i> sp.		1		
Limnephilidae				
<i>Ironoquia</i> sp.	1		1	
<i>Neophylax</i> sp.	1			
<i>Pycnopsyche</i> sp.	1	1	2	4
Philopotamidae				
<i>Chimarra</i> sp.	12	2	5	3
Polycentropodidae				
<i>Polycentropus</i> sp.		1		
Psychomyiidae				
<i>Lype diversa</i>				2
Rhyacophilidae				
<i>Rhyacophila</i> sp.		2	6	8
Diptera				



Table 3. Continued

Taxon	Station			
	1-A	2-A	1-B	2-B
Ceratopogonidae				
<i>Forcipomyia</i> sp.			1	
Genus spp.			3	
Chironomidae				
<i>Ablabesmyia</i> sp.	2	2		2
<i>Conchapelopia</i> spp.	1	4	1	1
<i>Eukiefferiella</i> sp.	3			
<i>Microtendipes</i> sp.			1	3
<i>Orthocladius</i> sp.	1			
<i>Parachaeotocladius</i> sp.			1	
<i>Parametriocnemus lundbecki</i>	1		4	11
<i>Paratendipes albimanus</i>	3			
<i>Polypedilum aviceps</i>	18	1	58	204
<i>Psectrocladius</i> sp.		1		
<i>Rheotanytarsus</i> spp.	2	1	4	18
<i>Stenochironomus</i> sp.		2		
<i>Stictochironomus devinctus</i>	1			
<i>Tanytarsus</i> spp.				1
<i>Thienemanniella</i> sp.	2			1
<i>Tribelos jucundum</i>		12		
<i>Zavrelimyia</i> sp.		2		1
Psychodidae				
<i>Telmatoscopus</i> sp.			1	
Simuliidae				
<i>Simulium</i> spp.	15		8	80
Tipulidae				
<i>Helicus</i> sp.		1		
<i>Hexatoma</i> sp.		2		
<i>Tipula</i> spp.	1	3	12	12

Table 3. Continued

Taxon	Station			
	1-A	2-A	1-B	2-B
TAXA RICHNESS	33	38	21	29
NUMBER OF SPECIMENS	139	187	170	451
EPT INDEX	13	13	7	10
EPT ABUNDANCE	59	112	61	103
CHIRONOMIDAE TAXA	10	8	6	9
CHIRONOMIDAE ABUNDANCE	34	25	69	242
EPT/CHIRONOMIDAE ABUNDANCE	1.74	4.48	0.88	0.43
PERCENT DOMINANT TAXON	14	28	34	45
COMMUNITY LOSS INDEX	--	0.32	--	0.28
SIMILARITY INDEX	--	0.42	--	0.35

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